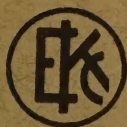


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COLLODION

the making of Wet Plate
Negatives for Photo-
Engraving Work



Eastman Kodak Company
Rochester, N. Y.



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COLLODION

and the making of Wet Plate Negatives
for Photo-Engraving Work

*A handbook of information concerning
the production of wet plate negatives
by simple and sure methods*

Eastman Kodak Company
Rochester, N. Y.

1928

Practical Methods of Collodion Negative Making

COLLODION is made by dissolving a soluble cotton or pyroxylin in a mixture of equal parts of alcohol and ether. To make this soluble cotton, absorbent cotton is treated with a mixture of nitric and sulphuric acids. It is then very thoroughly washed with water to get rid of all the acids, the water removed and after the cotton is thoroughly dry it is dissolved in the alcohol and ether, and such dissolved nitrated cotton forms plain collodion.

Collodion is used in wet plate negative making as a convenient medium for pouring on to a glass plate to form a film, porous when moist; at the same time it is a suitable vehicle to hold various iodides. When this film is treated with a silver nitrate solution, the iodides are converted to silver iodide which is held suspended in the collodion, and affords the sensitive material upon which the latent image is formed by exposure to light.

Eastman plain collodion will keep indefinitely as long as it is not iodized, in fact it rather improves by keeping. It is not sensitive to light, not even when the iodizer is added. Only when the iodized collodion is placed in the silver bath is a silver iodide formed which precipitates in the collodion film, and this silver iodide is sensitive to light. After exposure has formed a latent image, the developer has the effect of causing the silver from the bath solution which remains on the surface of the film to be deposited in the form of metallic silver on the latent image. Fixing removes the iodide of silver and all that remains then is the deposited metallic silver image on the clear collodion film.

It has been suggested that we describe the way in which Eastman Collodion should be used in photo-engraving work. We therefore tell in the following pages exactly how it is used in our own Engraving Department every day.

There are very many different formulae for working wet collodion. Without saying that those we use are the best, we do know that they are thoroughly satisfactory and probably as simple as any that can be worked.

Cleanliness is essential for the successful working of all photographic operations, and particularly so with wet collodion. The dark-room must be kept clean and well ventilated, if trouble is to be avoided. This is most important.

COLLODION

Preparation of the Glass

New glass, or old negatives, if not varnished, should be soaked in

| | | | | | | |
|-------------|---|---|---|---|---|---------------------|
| Nitric Acid | - | - | - | - | - | 1 quart (32 ozs.) |
| Water | - | - | - | - | - | 1 gallon (128 ozs.) |

Old negatives, if varnished, should be soaked in lye made as follows:

| | | | | | |
|--------------------|---|---|---|---|---------------------|
| Crude Caustic Soda | - | - | - | - | 2 lbs. |
| Water | - | - | - | - | 1 gallon (128 ozs.) |

When the film is loosened, scrub it off and put the glass into the nitric acid solution and let it soak for a few hours, 24 hours preferably. The plates should then be scrubbed under the tap with a soft scrubbing brush or pad of felt, and well rinsed. If the glass is not properly cleaned, fog and streaks will inevitably result. The glass, while still wet, is flowed with the following solution:

| | | | | | |
|------------------|---|---|---|---|-------------------|
| White of one egg | | | | | |
| Ammonia | - | - | - | - | 10 minims |
| Water | - | - | - | - | 1 quart (32 ozs.) |

The egg-white must be well beaten, and the solution filtered. While the plate is still wet it is flowed once with the substratum and drained, and then flowed again, drained, and put to dry in a dust-free place.

Dried albumen, of which 70 grains is equal to one ounce of fresh egg-white, is sometimes used instead of fresh albumen, but some dried albumens are not suitable and the fresh egg-white is better. A gelatin substratum may be used if preferred:

| | | | | | |
|---------------------|---|---|---|---|--------------------|
| Gelatin | - | - | - | - | 150 grains |
| Glacial Acetic Acid | - | - | - | - | 150 minims |
| Water | - | - | - | - | ½ gallon (64 ozs.) |

Or Eastman Rubber Solution, diluted with benzol, may be used:

| | | | | | |
|-------------------------|---|---|---|---|---------|
| Eastman Rubber Solution | - | - | - | - | 1 oz. |
| Pure Benzol | - | - | - | - | 10 ozs. |

This rubber solution can only be poured on after the glass is dry.

If it is preferred not to substratum the plates they should be allowed to dry after scrubbing and rinsing as above, then sprinkled with this solution:

| | | | | | |
|--------------------------------------|---|---|---|---|--------------------|
| Iodine | - | - | - | - | 200 grains |
| Denatured alcohol (free from grease) | | | | | ½ gallon (64 ozs.) |

COLLODION SOLUTION

and polished off with a piece of lintless rag or chamois leather. Glass that is not substratumed should be edged with rubber solution applied with a small brush, which is better than absorbent cotton.

The glass having been prepared, it has now to be flowed with collodion.

The Collodion Solution

Eastman Complete Collodion is supplied in two containers, one containing the plain collodion and the other the iodizer. The reason for this is that an iodized collodion gradually gets slower as it ages, but the plain collodion and iodizer separately will keep indefinitely, as long as the bottles are kept well corked. Collodion should always be kept in a cool place, otherwise the cork may be blown out and rapid evaporation go on. Add the contents of the 2 oz. bottle of iodizer to half a gallon of plain collodion and the collodion is complete and ready for use. *Do not add anything else.* It works best after it has been iodized a few hours, but it can be used at once and will keep for months without losing very much speed, but as it does eventually lose speed after iodizing, it is recommended that not more be iodized than will be used up in about two weeks. As this collodion is filtered through $\frac{1}{2}$ " thick filter paper under pressure, there is no need to refilter. But if it is thought desirable to filter again after iodizing, use a small filter loosely fitted with absorbent cotton, in order to minimize evaporation.

Eastman Complete Collodion is equally suitable for either half-tone or line work.

If Collodion is Too Thick

Eastman Complete Collodion will never be found too thin, but if a thinner collodion is required, add a mixture of equal parts of pure grain alcohol and ether to the plain collodion and then add 2 ozs. of iodizer to every half gallon of the thinned plain collodion. If a thinner and also softer-working collodion is required, use Eastman Special Iodizer, which contains more solvents as well as iodizer of a different formula. Take 1 part of this to 2 parts of Eastman Plain Collodion, this makes a collodion half again as thin.

Eastman Special Iodizer may also be used to thin down regularly iodized collodion that has become too thick from evaporation of the solvents.

COLLODION

As Eastman Collodion is made up in very large quantities each time, under the most rigid tests at every stage, it will be found to be uniform. If you find any differences in working, you may be fairly certain it is not due to the collodion, but that some other condition under which you are working has been changed.

This collodion is equally good for line work and half-tone work. It is a mistake to suppose that different collodions are required for line and half-tone work. A half-tone screen negative is exactly the same as a line negative inasmuch as the black dots have to be as dense as possible and the clear spaces quite transparent. If the collodion is good for line work, it is also good for screen negative making and vice versa, though if you have both old and new collodion, use the old for line work and the new for half-tone, because the new collodion is faster.

If using a freshly iodized collodion for line work, be careful not to over-expose. To get the best results with fine line work, use the collodion after it has been iodized for some time and is well ripened, and use a weaker silver bath.

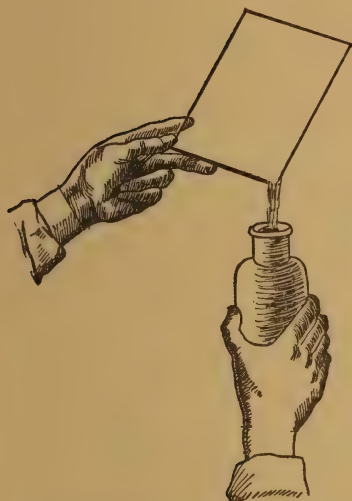
Before coating a plate, it should be first carefully dusted with a camel's hair brush kept specially for the purpose. If the brush is not clean it may leave more dust on the plate than it takes off. Never leave this brush lying on the bench, but keep it hanging up.

The Operation of Coating

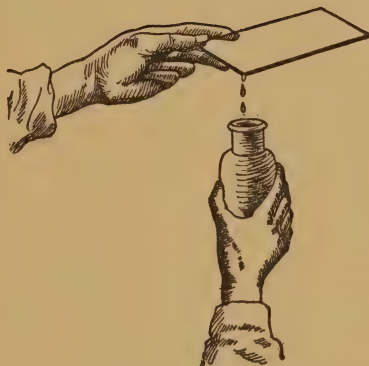
Hold the plate horizontally either on a holder or with one corner resting on the two first fingers of the left hand and held down by the thumb.

The collodion bottle is taken in the right hand and the collodion is poured in a pool on the upper part of the plate, the right top corner being covered during the pouring and the plate gently tilted so that the left top corner is next covered, then the left bottom corner and finally the excess of collodion drained off at the right bottom corner. During these operations, the bulk of the collodion should be kept well in the middle of the plate, which is only tilted sufficiently for the collodion to flow to the edge, but not over it and off the plate. At all points, care must be exercised that the edge of the collodion is kept flowing forward all the time and that no flow-back occurs; otherwise the collodion will thicken and cause a mark in the negative. The draining of

COATING THE PLATE



The wrong way to commence to drain the excess collodion from the plate, which is tilted too much



The right way to commence to drain the excess collodion from the plate, which is kept as nearly horizontal as possible

the excess of the collodion should be done very gradually into a wide mouthed bottle, the plate being tilted only slightly at first, and then being gradually brought up to a vertical position. During the whole of the draining, the plate must be rocked through almost an entire right angle, so that the collodion flows down toward the edges of the plate, and then to the corner, rather than immediately toward the corner. Ribbed markings are nearly always caused by hasty and improper draining of the collodion. As the draining is completed and the plate becomes more and more vertical, the excess bottle should be moved with the plate, not scraped against it. Care should be taken to pour just the right quantity of collodion upon the plate, for the size being used. Any excess of the correct amount will cause the plate to be tilted too steeply and produce striation, besides wasting the collodion that drips over the sides of the plate.

When the film has set, which is ascertained by touching one of the thickened edges with the finger, the plate is immersed at once in the silver sensitizing bath. It is important to do this at once in hot weather for, if delayed, the end first flowed will dry up and refuse to sensitize.

COLLODION

The Silver Bath

The silver bath being the most important solution used in the process, great care should be exercised in its preparation and use. Cleanliness is essential. Keep all dust and contaminating substances away from the bath. Have the dark-room clean, thoroughly well ventilated, and free from dust so that the bath may be left uncovered without any danger, as this allows the collodion solvents in a used bath to evaporate to some extent. Use Eastman Silver Nitrate, the purest silver nitrate possible to procure.

Make up the following bath:

| | | |
|------------------------|-----|------------------------------|
| Eastman Silver Nitrate | - | 10 ounces |
| Distilled Water | - - | 3 quarts, 14 ozs. (110 ozs.) |
| Potassium Iodide | - - | 5 grains |

If this bath is tested with a silver solution hydrometer, sometimes called an argentometer or actinometer, it will be found to register 40 (i. e., the number of grains per ounce), which is a strength generally preferred for half-tone work. For line work, a weaker bath is better, and if instead of the amount of water given above, 1 gallon is taken, this will give a bath containing 35 grains to the ounce which is a good strength for all 'round work. A common practice, to which there is no objection, is to omit the iodide and allow a collodionized plate to remain in the bath for a few hours. If distilled water cannot be obtained, tap water may be used and the bath after dissolving set out in the sunlight until the cloudy precipitate is settled. The bath should always be stood in the sunlight when not in use, and any organic matter will then be reduced as a black precipitate. Make enough solution for two baths, so that one is always out in the light when the other is in use. When ready to use the bath, filter, and add 10 minims of pure nitric acid, just enough to make the bath acid, but not too strongly acid. A bath can be tested for this with litmus paper; it should turn blue litmus paper gradually red. If it turns red litmus paper blue, then acid must be added.

Be sure to have a big enough vessel for the silver bath, and enough solution to allow some movement while in the bath to the largest plate it is required to sensitize, otherwise streaks are bound to occur. Keep the bath cool, as if too hot fog is probable, and be particular to see that the bath is not contaminated with fumes. The fumes from burning coal gas are almost certain to cause black spots.

THE SILVER BATH

Treatment of the Silver Bath

The bath should not be tinkered with. A bath made as directed, used for Eastman Collodion, will keep indefinitely. When it gets over-iodized pour into a clean, clear glass bottle containing about one-third water, which will precipitate the excess of iodides. Now test with the hydrometer, and add silver nitrate until the hydrometer reads 40 (or 35 if that is the strength used). Neutralize acidity by putting in a crystal of carbonate of soda. Then stand in the light until all the precipitate has settled, filter, re-acidify with pure nitric acid and the bath is ready for use. When Eastman Silver Nitrate is used, unless the bath has been over-acidified, neutralization with the soda may be omitted, and then it will be unnecessary to re-acidify the bath. If the bath gets overloaded with alcohol from the collodion plates sensitized in it, put into an evaporating dish and boil down. When nothing else is wrong, only about one-third need be boiled away, but if the bath is giving fog through the presence of organic impurities, it should be boiled down until it forms a pasty mass, the heat continued until it becomes liquid again and then allowed to cool. The resulting fused silver nitrate is dissolved in some distilled water, and this poured into the quantity of water required to make the bath to its original volume, tested with the hydrometer, made up to strength with silver nitrate and stood in the sun for a few days. Filter and acidify, and the bath is again ready for use.

If negatives are not right, seek other causes before deciding it is the bath. Is the glass quite clean? Is the air of the dark-room fresh and free from dust? Is the developer right? Suspect the bath last, and in any case it is best to avoid the addition of various chemicals sometimes recommended. They are never necessary, as any bath, if out of order, can be put right by sunning, or by boiling down. If these simple instructions are attended to, there will never be any trouble with the preparation of wet collodion plates, assuming, of course, that Eastman Complete Collodion and Eastman Silver Nitrate are used.

The Right Amount of Iodizer

When a collodionized plate is put into the silver bath, the silver nitrate combines with the iodides in the collodion and forms silver iodide. This gives a creamy film and some-

COLLODION

times operators think that the whiter the appearance of the plate in the bath, the better their negatives will be, but this is not so.

There is a certain amount of iodides in the collodion that will give the densest image. This amount is contained in the Eastman Iodizer; more iodides will not give any better negative and therefore the extra iodides, although they make the plate look whiter in the bath, have no good effect at all, but rather a bad effect, inasmuch as they consume the silver nitrate and make the bath become over-iodized more quickly than is necessary. When a bath has become over-iodized, silver iodide will precipitate on the plate as a sort of sandy deposit and these particles wash off on development, leaving a granular negative with pinholes. Pinholes are also caused in an unused bath that contains no iodide at all; they are caused by the iodide being eaten out of the collodion film to satisfy the affinity of the silver bath for iodide. This trouble however would not last for more than the first or second plate in any case.

Sensitizing the Plate

The plate must be immersed in the bath solution in one even action, so that the solution flows on the plate without any stoppage, otherwise a "bath mark" line will show in the negative. The plate is gently moved (or if a tray is used the tray rocked) immediately on placing in the bath, and is better occasionally moved (or the tray rocked) during sensitizing which should be completed in about 3 minutes. If the bath is alcoholic, leave the plate in for about one minute after all greasiness has disappeared. Take the plate out of the silver bath, allowing as much solution to drain back into the bath as possible, and, being careful not to let anything off the hands get onto the plate or into the silver bath, stand the plate on a piece of clean blotting paper and wipe the back with blotting paper or lintless rag. Provide the dark slide with a strip of blotting paper on which to stand the plate to absorb the silver drainings which are corrosive and soon ruin woodwork with which they come in contact. Plate holders should be wiped over carefully with a damp rag at the end of the day's work, and all parts on which silver drainings are liable to touch should be coated with shellac once a month.

DEVELOPING AND FIXING

Development

After exposure the plate is developed, a suitable developer being:

| | | | | | | |
|---------------------|---|---|---|---|---|------------------|
| Iron Sulphate | - | - | - | - | 4 | ozs. |
| Glacial Acetic Acid | - | - | - | - | 4 | ozs. |
| Water | - | - | - | - | ½ | gallon (64 ozs.) |

More acid may be added in hot weather up to another two or three ounces, if there is any tendency to fog.

A small quantity of denatured alcohol may be added to the developer if the bath is old and plates tend to repel the developing solution. Cover the plate with developer without any stop or it will leave a mark. Do not use more developer than is necessary, because as little silver nitrate solution should be washed off the surface of the plate as possible, since the strength of the image depends upon the amount of silver left on the top of the plate. Exposure should be such that a good image is obtained with a development of 20 to 30 seconds. If the development veils the plate, over-exposure is indicated; on the other hand, forcing development causes grain in the clear spaces. This and over-intensification will cause "dry effect" and possibly film splitting, especially if the glass was not thoroughly clean.

Do not trouble to look at negatives with a magnifying glass during development, as, if the exposure is incorrect, you cannot make it right in development. After development the developer must be thoroughly washed out of the collodion, otherwise it will cause a stain on the negative. Wash at least 20 seconds under a good stream of water, and longer if any tendency to stain occurs.

Fixing

A 10% solution of potassium cyanide (30%) is flowed over the plate to fix. If a tray is used the plate should be left in twice the time it takes the white silver iodide to disappear. If a plate is left too long in the cyanide, the fine detail will tend to be dissolved away. If potassium cyanide cannot be procured, sodium cyanide will do equally as well. Both are *deadly poisons*, and bottles containing cyanide solutions should be conspicuously labelled "poison."

| | | | | | | |
|-----------------------------|---|---|---|---|---|-----------------|
| Potassium or Sodium Cyanide | - | - | - | - | 2 | ozs. |
| Water | - | - | - | - | 1 | quart (32 ozs.) |

If 90% cyanide is used, take 3 quarts of water instead of one.

COLLODION

Hyposulphite of soda 12 ozs. to 32 ozs. water may be used. It is just as efficient as cyanide but is not quite so instantaneous. Wash well after fixing.

Intensification

The commonest intensifier is Copper-Bromide and Silver. Make two solutions:

| | | | | |
|-------|---------------------|---|---|--------------------|
| No. 1 | Copper Sulphate | - | - | 12 ozs. |
| | Water to make up to | - | - | ½ gallon (64 ozs.) |
| No. 2 | Potassium Bromide | - | - | 6 ozs. |
| | Water to make up to | - | - | ½ gallon (64 ozs.) |

When dissolved, mix the two solutions and the bath is ready. The plate is placed in the solution until it is bleached white right through; it is then washed for not more than one minute, care being taken not to allow the water to run only on one spot. The plate is well drained and blackened by pouring over

| | | | | | | |
|---------------------|---|---|---|---|---|---------|
| Silver Nitrate | - | - | - | - | - | 1 oz. |
| Water to make up to | - | - | - | - | - | 12 ozs. |

Freshly made silver solution for intensification will often give streaks, but the addition of a few drops of nitric acid will insure its working smoothly.

The washing, before blackening, must not be too prolonged or the plate will not blacken. On the other hand, if it is not washed long enough, silver bromide will be precipitated by the silver nitrate solution.

If the negative is not sufficiently dense it may be intensified a second time, proceeding as above.

The silver solution should be of the strength given, as the use of a weak silver solution for intensification will give trouble in reducing. The plate may reduce suddenly and unevenly.

To Get Maximum Intensification

To get the utmost intensification the following intensifier can be used.

| | | | | | |
|----------------------|---|---|---|---|--------------------|
| Lead Nitrate | - | - | - | - | 3 ozs. |
| Potass. Ferricyanide | - | - | - | - | 3 ozs. |
| Glacial Acetic Acid | - | - | - | - | 3 ozs. |
| Water to make up to | - | - | - | - | ½ gallon (64 ozs.) |

The plate is placed in this until the color is evenly yellow right through, it is then washed thoroughly and flowed with

INTENSIFICATION AND REDUCTION

a weak nitric acid solution (1 to 30), rinsed again and blackened with

| | | | | | |
|---------------------|---|---|---|---|------------------|
| Sodium Sulphide | - | - | - | 4 | ozs. |
| Water to make up to | - | - | - | ½ | gallon (64 ozs.) |

or ammonium sulphide may be used if there is no objection to the unpleasant smell. The plate is once more rinsed and again flowed with weak acid, rinsed and then flowed with gum arabic or weak glue solution, to protect the film.

Any necessary reduction of the negative to be intensified with lead ferricyanide must be done before it is intensified as it cannot be done afterwards.

Sometimes for fine line work, the mercury intensifier is used.

| | | | | | |
|---------------------|---|---|---|---|------------------|
| Mercuric Chloride | - | - | - | 5 | ozs. |
| Ammonium Chloride | - | - | - | 3 | ozs. |
| Water to make up to | - | - | - | ½ | gallon (64 ozs.) |

The bleaching of a wet plate negative in this solution is slow, but it may be hastened by warming the solution. After thorough washing, the blackening is done with:

| | | | | | |
|---------------------|---|---|---|---|-----------------|
| Ammonia Water | - | - | - | 3 | ozs. |
| Water to make up to | - | - | - | 1 | quart (32 ozs.) |

Any reduction necessary in this case should also be done before the intensification.

Reduction, Cutting or Clearing

The usual method of reduction is to bleach the plate after intensification in the following solution:

| | | | | | |
|---------------------|---|---|---|---|------------------|
| Potassium Iodide | - | - | - | 2 | ozs. |
| Iodine resublimed | - | - | - | 1 | oz. |
| Water to make up to | - | - | - | ½ | gallon (64 ozs.) |

After bleaching it is flowed over with a weak solution of cyanide.

| | | | | | |
|-----------------------------|---|---|---|---|------------------|
| Potassium or Sodium Cyanide | - | - | - | 1 | oz. |
| Water to make up to | - | - | - | ½ | gallon (64 ozs.) |

The negative must be carefully watched during this operation as it is very easy to over-reduce and so ruin it.

Some operators prefer to reduce with one solution, adding the iodine solution to the cyanide, pouring the combined solution over the negative.

COLLODION

In the absence of iodine solution, reduction may be effected by using the copper-bromide solution for a bleaching bath, followed by weak cyanide solution.

After the reduction is complete, the plate is rinsed and flowed with a weak solution (1 to 20) of nitric acid and finally blackened by flowing over with

| | |
|---------------------------|--------------------|
| Sodium Sulphide - - - - | 4 ozs. |
| Water to make up to - - - | ½ gallon (64 ozs.) |

If there is any sign of yellow stain, it is removed by flowing with weak nitric acid solution, the plate is then flowed over with gum solution:

| | |
|-----------------------------|-------------------|
| Gum Arabic (or Fish Glue) - | 1 oz. |
| Water - - - - - | 1 quart (32 ozs.) |

Sometimes Farmer's Reducer is used.

This is made as follows:

| | |
|------------------------------|------------------|
| No. 1 Hypo - - - - | 4 ozs. |
| Water - - - - - | 1 pint (16 ozs.) |
| No. 2 Potass. Ferricyanide - | 1 oz. |
| Water - - - - - | 1 pint (16 ozs.) |

Take the No. 1 solution and add an equal amount of water, then add enough of the No. 2 solution to make it orange colored. Use immediately as it will not keep mixed. The plate will require thorough washing after the use of this reducer.

Stripping

To reverse a negative, or transfer a number to a large piece of glass, negatives are stripped.

After thorough drying, and when cool, the negative is flowed over with rubber solution. Eastman Rubber Solution is prepared ready for use and is exactly right for the purpose. It is intentionally made thin. When the rubber is dry the plate is coated with Eastman Stripping Collodion, which is plain collodion containing a small quantity of castor oil.

Do not condemn Eastman Stripping Collodion should it be somewhat thinner than other stripping collodions. Provided it is tough and flexible the thinner it is the better, as it is easier to flow and quicker to dry. When the film is dry it is cut around with a knife and the negative put into

| | |
|---------------------------|-------------------|
| Glacial Acetic Acid - - - | 2 ozs. |
| Water - - - - - | 1 quart (32 ozs.) |

until the film commences to lift. Remove the plate from the bath and lift up the film by the corner with a pocket knife

STRIPPING

and transfer to position required, turning over if necessary. To be quite sure film is not damaged or stretched, it may be handled on paper. Thoroughly wet a piece of thin paper so that all stretch is taken out and bring into contact by means of rubber roller or other squeegee. Lift one corner of the paper and with it a corner of the film which may be started with the point of a pocket knife, and the paper and film drawn off together. For reversing, the film is now transferred to another piece of paper, the paper and film trimmed with scissors and then laid on to glass, preferably moistened with a little gum water. If not to be reversed, the transfer to the second piece of paper is of course omitted. The film can be squeegeed down evenly by stroking with a few pieces of 3" x 3" hard blotting paper, or a piece of velvet rubber. If the latter is used, keep in water when not in use so that it remains soft and pliable.

Blisters are caused by pouring the stripping collodion on when the plate is too warm, or heating the plate too much before collodion has set, or having air-bells in bottle containing the collodion. Be sure to have the negative quite dry before applying rubber or stripping collodion.

Stripping Simplified

With Eastman Negative Collodion it is possible to dispense with rubber and collodion, as the negative film itself is tough enough to be stripped without any strengthening. After the negative is dry the film is cut around, and a piece of paper placed on that has first been well wet with 5% Acetic Acid Solution. After the film is loosened it is transferred as described above.

Sometimes negatives are varnished to protect them, Eastman Engraver's Hard Varnish being used.

Negatives from which many prints are to be made should be protected. A good plan is to cover them with No. 1 Kodaloid, a thin transparent sheet that can be fastened to the corners of the negative with Eastman Film Cement. It is easily replaced if it should be damaged.

Negatives which it is advisable to keep, should be stripped on to Kodaloid No. 6. This is light, unbreakable, occupies little space for storage, and the negative is instantly available at any time for reprinting, just as easily as though it were on the original glass.

COLLODION

Defects

Do not blame the materials until you are quite sure that there can be no other cause for defects. All Eastman goods are made up in very large quantities under the most rigid tests at every stage, and it is unlikely they should be at fault.

The following are some of the commonest causes of defects met with in wet collodion work. Some other possible defects have been dealt with in the foregoing text.

DIAGONAL RIBBING OR STRIAE. This is caused by rocking the plate through too narrow an angle when coating it, or not rocking enough. The plate should be coated with just about the right quantity of collodion, flow it slowly and evenly over the plate, and allow most of the excess to drain off while the plate is almost horizontal. If the draining is too rapid at first, the coating is very likely to become thinner at the top and thicker at the bottom, and so gives uneven negatives, and if in addition it is brought too quickly to a vertical position, and rocked rapidly through a narrow angle (instead of slowly through a right angle) the film will almost inevitably show ribbed markings. See illustration on page 7. If the collodion is too thick, it should be thinned before iodizing or Eastman Special Iodizer be used. Always keep collodion tightly corked, or it will thicken by evaporation.

OTHER STREAKS may be caused by removing the plate from the bath too soon, especially if the bath has become loaded with alcohol. Scum on the bath, bubbles, or dust in the collodion will also cause streaks. Dirty glass will also cause streaks. Stopping the even flow of the bath over the plate when sensitizing, or the even flow of the developer when developing will cause streaks.

COLLODION FOUND SLOW. Eastman complete collodion is as fast as, or faster than, any collodion procurable. If it has been iodized for a very long time it will be slower than when freshly iodized; do not iodize too much at a time. Before it is condemned as being too slow, make sure that it has had a fair trial.

Make sure your lights are right, your lens is clean, and developer correct; test it against some other collodion under exactly the same conditions when it will be found at least as fast. Compared with any other collodion under exactly the same conditions it will never be found slower.

DEFECTS AND REMEDIES

COLLODION TOO SOFT. This is sometimes found in conditions of high temperature with much humidity. Some operators find that collodion resumes its quality if it is kept cool, by placing on ice.

PLATE TOO BLUE ON TAKING OUT OF BATH. See paragraph on page 9, "the right amount of iodizer." Make sure you have the right amount of iodizer. Do not thin down iodized collodion with solvent and forget to add more iodizer. 2 ozs. of Eastman Iodizer to every $\frac{1}{2}$ gallon (64 ozs.) of collodion is necessary but this is all that is necessary. With this amount of iodizer, if you think the plate is too blue, try an exposure; you will find that you will not get more density even if you put in more iodizer.

SILVER SOLUTION REFUSES TO BLACKEN negative after bleaching in copper bromide. The cause is silver nitrate solution is too weak or insufficiently acid, or the bleached image has been washed too long.

UNEVEN NEGATIVES may be caused by:

1. Uneven coating.
2. Placing plate in silver bath after the collodion has been set too long. This produces insensitiveness at the edges and may also cause the film to become contractile and so split on drying. The moving of the plate or rocking of the bath should not be in one direction only, especially if it contains much alcohol, as this may produce long streaks.
3. By not allowing the developer to flow evenly over the plate, or pouring on one spot, or allowing it to remain on one part longer than another. Keep the plate moving gently and pay special attention to see that the developer is kept evenly distributed over the plate.
4. By leaving in too strong a fixing solution.
5. Constantly pouring the reducer on one side of the film.

HALF TONE DOTS FUZZY. Due either to incorrect relation between screen separation and stop size, or insufficient exposure.

GRAIN ON THE NEGATIVE. Caused by too prolonged development. It is noticeable in under-exposure, where the temptation is to force development. Developer too strong in iron sulphate will also cause grain. Use the formula on page 11.

COLLODION

SCUM ON NEGATIVE. Usually due to dirt somewhere. Glass not properly clean, silver bath dirty, dark slide dirty. If scum is evenly all over surface it may be due to high temperature of dark-room, insufficient ventilation or developer insufficiently acid.

FOG. A reduction of metallic silver on parts of the negative which should be clear, may arise from a variety of causes. It is shown on the negative by a gradual or, in some cases, by a sudden darkening all over the film or it may only spread over a small portion. Some of the causes are:

1. An insufficiently acid state of the silver bath is one of the most frequent causes of fog; if the bath is suspected, test it with blue litmus paper and should it be in this state, the litmus paper will only slightly discolor. Add, drop by drop, a 10 per cent. pure nitric acid solution to the bath solution until it turns the blue litmus paper a decided red color. But too much acid prevents the bath sensitizing at all.

2. By light making its way to the plate through cracks in the bellows of the camera, and also by internal reflections. Cracks can be located by placing one's head in the back of the camera and covering the space between the camera and the head with a focussing cloth, thus excluding all light. When the eyes have become accustomed to the darkness, any cracks will reveal themselves.

3. Unsafe dark-room illumination. Coat and sensitize a plate in the shade, expose half to the lamp suspected, keep the other half covered, develop, and if the light is unsafe the exposed part will show fog. The yellow light employed in a wet plate dark-room may be bright, but must not contain any blue, violet or ultra-violet light. Wratten No. 0 Safe-light fulfils these conditions.

4. Fumes of some chemicals, turpentine and fresh paint are liable to produce fog, as also is smoke. Ammonia and ammonium sulphide fumes sometimes make their way into the dark-room and cause fog. Fumes from burning gas or electric arcs may cause fog. Keep the dark-room well ventilated and prevent any fumes from entering if possible.

5. Dirty glass, new glass that has not been sufficiently soaked in acid, imperfectly cleaned dry plate glass, a dirty wash-leather or cloth. Clean these latter by soaking in soda solution and rinse in clean fresh water; do not use soap. The fog arising from this cause may be generally detected

DEFECTS AND REMEDIES

by examining the back of the plate, when a peculiar iridescent appearance may be seen. Decomposed albumen solution used for substratum may cause fog. Some albumen substitute or dried albumens are not suitable for substratum and always cause spots and fog. Use fresh egg-white.

6. Impure solvents employed in making rubber edging solution will show a fog which commences from the edge of the plate and gradually spreads toward the center. Use Eastman Rubber Solution.

7. Aprons upon which Sodium Sulphide or Ammonia have been spilt will cause, especially in hot weather, a fog to appear on that side of the negative that has been held near the body. Fingers stained with these chemicals will give fog in the portions of the plate which they have been near.

8. Some collodions when freshly iodized have a tendency to give fog; should this be the case, add a few drops of a 10 per cent. solution of iodine in alcohol until the collodion assumes an orange color, or place aside to ripen. An iodized collodion of a light yellow color is more liable to fog than one of a darker orange or red color; the former is, however, the faster working of the two. There is no danger of fog when using Eastman Complete Collodion, nor any necessity to add iodine to it.

9. A developer lacking in acetic acid, or one that is too warm or too strong. Use the formula on page 11.

10. A new bath will sometimes give a surface fog which can be removed with a pad of absorbent cotton applied with care to the surface of the film while the water is running upon it. If this is at all troublesome, add a little more acid to the developer.

11. The use of impure chemicals will cause fog. Use Eastman Tested Chemicals.

12. One of the worst causes of fog, because usually unsuspected, is insufficient ventilation in the dark-room.

“DRY EFFECT” (so called). A relief appearance of the image on the negative after it is dry, making it difficult to strip and difficult to print, is due entirely to excessive intensification. If sufficient exposure is given so that only a normal intensification is needed, this effect will not occur.

GROUND GLASS EFFECT or graininess is caused by underexposing and forcing development. The remedy is to give more exposure and shorten development.

COLLODION

SPLITTING NEGATIVES are due to too much intensification. Fine cracks after lead intensification may be caused by collodion being too thick. Thin the collodion, give full exposure and short development. See that substratum is not too weak. If collodion is allowed to get too dry before sensitizing it may crack.

With some collodions splitting may occur through the solvent being too anhydrous, but this will not be the case with Eastman Complete Collodion, as solvents are carefully tested before use.

BLISTERS OR BUBBLES when stripping. Due to putting rubber solution or the stripping collodion on the plate when too warm.

BLACK SPOTS AND COMETS. Due to dust falling on the plate before or after albumenizing, while being coated, or already in collodion. Developer not being filtered. Dried particles of collodion especially from mouths of dirty collodion bottles. Dry plate developer dust floating about the room produces very bad spots. Chemicals should never be mixed in sensitizing room. Coal gas being burned nearby will sometimes cause spots. Be most particular to have the dark-room thoroughly well ventilated and kept free from dust. Sulphur from hard rubber dipper is said to cause spots. Varnish the dipper with shellac. Sometimes wooden or composition baths used as containers for the silver bath will cause spots. See that the shutter of the plate holder does not grind; if so, this may cause dust to settle on the plate and give rise to spots. Building operations in the neighborhood are liable to cause spots. Use muslin over the open windows.

FINE BLACK LINES are caused by scratches in the glass which has not been sufficiently cleaned. They may usually be removed by turning over the negative film and wiping off with a piece of wet cotton. But see that the glass is more thoroughly cleaned to prevent this defect.

SMALL TRANSPARENT SPOTS (PINHOLES). Due to bath being over-iodized. A somewhat less definite spot may result from an under-iodized bath. Hypo dust will cause a transparent spot. Keep solid hypo out of the room, and do not let any hypo solution fall on the bench or floor to crystallize.

BROWN STAIN ON BLACKENING WITH SULPHIDE. This is generally due to insufficient washing between developing

DEFECTS AND REMEDIES

and fixing, but it may be caused by using a stale and exhausted fixing bath.

A BLUE STAIN after bleaching with lead is due to insufficient washing after development.

AN OPALESCENT STAIN is produced by insufficient fixing.

IRREGULAR CLEAR MARKS. Produced by plate being immersed in silver bath before collodion has set, the water of the bath precipitating the cotton.

SHARP LINE ACROSS PLATE. Bath marks made by the first flow of the sensitizing solution not completely flooding the plate, or a stoppage of the developer when flowing over the plate.

MOTTLING AND STREAKS. Sometimes caused by not rocking or moving sufficiently during sensitizing.

METALLIC STREAKS. In very cold and dry weather streaks are caused with a collodion that has been made with solvents that are too dry. Try adding a few drops of water.

“OYSTER-SHELL” MARKINGS. Generally due to one of the following:

Dirty plate holder (the plate holder should be wiped out every day with a wet cloth and once a month varnished inside with shellac varnish). Dirty or sodden blotting paper. Insufficient draining when removing plate from silver bath. They are very liable to show with a new bath. Add a little old bath to the new one if you have it. Usually a longer draining of the plate, rocking it at the same time, will avoid oyster-shell markings.

FILMS REFUSING TO STRIP. Due to dirty glass, or impure Rubber Solution. Use clean glass and Eastman Rubber Solution. More acetic acid must be used in which to soak old negatives; it is sometimes impossible to strip a very stale negative.

FILMS NOT STICKING AFTER STRIPPING. Due to grease on glass, or impurities in stripping collodion. Use clean glass and Eastman Stripping Collodion.

PREVENTION IS BETTER THAN CURE. The list of defects seems formidable, but there will seldom, if ever, be any defects if the methods described are followed. Cleanliness especially should be practiced. Let the dark-room have frequent doses of fresh air, and daylight if possible. Use

COLLODION

Eastman Complete Collodion, Eastman Silver Nitrate and other Tested Chemicals and troubles will be as unknown as they are in the Eastman Engraving Department.

Part of the Eastman Service

Because it gives opportunity for testing materials, under the same conditions that the photographer meets, we have conducted our own photographic developing, printing and enlarging department for over thirty years. This department uses Eastman goods exclusively and thereby gives a double check on the practical utility of our products. It backs up theory with practice, and if goods which have been passed by our testing departments fail to hold up to the required standards, we know it quickly—not from the outside, but from our own experience in this separate department within our own walls.

But there is even a greater advantage than this. We learn by experience practical short cuts, and how to maintain efficiency, which information is passed on through our printed matter, through our correspondence and by actual demonstration to our customers right here in the department, as part of the Eastman service.

Because this Photographic Finishing Department has proved so valuable to our customers, and ourselves, we installed our own Engraving Plant. It has only one customer, the Eastman Kodak Company, but that one customer has enough work to maintain the plant on a commercial scale. It has to meet the every-day problems that all engravers meet and so is in a position to know our goods by practical test. It has therefore been of the utmost benefit to us in making our products *right*. But it goes beyond that: it is at the service of the photo-engraver, employer or workman, who needs information on any photo-engraving problem, whether he uses Eastman materials or not. It is a part of the Eastman Service.

EASTMAN KODAK COMPANY

ROCHESTER, N. Y.

PRICE LIST

All prices are f.o.b. shipping point and subject to change without notice.

Bottles and cans are not charged and are not returnable.

Interstate Commerce Commission Regulations provide that collodion may not be sent by express in bottles larger than one quart, though 20 quarts may be sent in one outside container. But boxed cans may go by express in any size up to 5 gallons. Collodion or Collodion Cotton cannot be sent by parcel post.

Do not be afraid to order Eastman Collodion in cans, as we make our own cans especially for it, and we know they are satisfactory.

Eastman Complete Collodion

Plain Collodion not iodized but *with* Iodizer in separate bottles; only requires adding the accompanying Iodizer to Collodion to form Complete Collodion:

| | Rochester Chicago & New York | San Francisco |
|-----------------------------------|------------------------------------|---------------|
| In 1 quart bottles - - - - | \$ 1.20 | \$ 1.50 |
| In ½ gallon bottles or cans - - - | 2.20 | 2.65 |
| In 1 gallon bottles or cans - - - | 4.00 | 4.70 |
| In 5 gallon cans - - - - | 18.00 | 21.35 |

Eastman Plain Collodion for Negative Making

Eastman Cotton dissolved in pure alcohol and ether, without Iodizer:

| | | |
|-----------------------------------|---------|---------|
| In 1 quart bottles - - - - | \$ 1.00 | \$ 1.30 |
| In ½ gallon bottles or cans - - - | 1.80 | 2.25 |
| In 1 gallon bottles or cans - - - | 3.50 | 4.20 |
| In 5 gallon cans - - - - | 16.00 | 19.45 |

Eastman Iodizer

Used with Eastman Plain Collodion will give a collodion yielding brilliant line and half-tone negatives.

| | | |
|---|--------|--------|
| In 1 oz. bottle (sufficient to iodize 1 quart of collodion) - - - - | \$.30 | \$.35 |
| In 2 oz. bottle (sufficient to iodize ½ gallon of collodion) - - - - | .50 | .60 |
| Per dozen 2 oz. bottles - - - - | 5.50 | 6.00 |

Eastman Special Iodizer

For making a thinner, softer-working collodion, 1 part of Special Iodizer is added to 2 parts of Eastman Plain Collodion:

| | | |
|-----------------------------|--------|---------|
| In 1 pint bottles - - - - | \$.80 | \$ 1.00 |
| In 1 quart bottles - - - - | 1.50 | 1.80 |
| In ½ gallon bottles - - - - | 2.60 | 3.05 |

COLLODION

Eastman Cotton for Making Collodion

A high grade, uniform product, packed in bottles and wet with solvent:

| | Rochester Chicago & New York | San Francisco |
|----------------------------|------------------------------------|---------------|
| In 1 ounce bottles - - - - | \$.30 | \$.35 |
| In 4 ounce bottles - - - - | 1.00 | 1.10 |
| In 8 ounce bottles - - - - | 1.50 | 2.00 |

Eastman Stripping Collodion (Ready for Use)

A flexible collodion of exceptional toughness:

| | | |
|-----------------------------------|---------|---------|
| In 1 quart bottles or cans - - - | \$ 1.00 | \$ 1.30 |
| In ½ gallon bottles or cans - - - | 1.80 | 2.25 |
| In 1 gallon bottles or cans - - - | 3.50 | 4.20 |
| In 5 gallon bottles or cans - - - | 16.00 | 19.45 |

Eastman Rubber Solution (Ready for Use)

Consists of pure masticated rubber dissolved in water-free benzol:

| | | |
|-----------------------------------|--------|---------|
| In 1 quart bottles or cans - - - | \$.80 | \$ 1.10 |
| In ½ gallon bottles or cans - - - | 1.20 | 1.65 |
| In 1 gallon bottles or cans - - - | 2.25 | 2.95 |
| In 5 gallon bottles or cans - - - | 10.00 | 13.45 |

Other Eastman Specialties for Photo-Engravers

Eastman Silver Nitrate

Taken without any discrimination from the same stock that we manufacture for our own use in making our high-speed photographic emulsions, and therefore must be of the highest purity.

Packed in bottles of 1, 4, 8, 16, 100 and 200 ounce capacity. The price is based on the market price of Silver Bullion. A slight advantage in price is offered to purchasers of 100 ozs., 500 ozs., 1000 ozs., and upwards. Current quotations will be forwarded immediately on request.

Eastman Engraver's Hard Varnish

A clean quick-drying varnish that forms a tough film for the protection of negatives:

1 quart \$1.90 1 gallon \$7.00

Wratten Safelight Lamp

The Wratten Safelight Lamp is radically different in construction from the ordinary dark-room lamp in that none but reflected light is permitted to pass.

The electric globe is placed inside the lamp at the top; the upper half of the lamp being fitted with a sheet of opal glass (for white light illumination) which can be covered with a light tight shutter.

PRICE LIST

By means of a white enameled curved reflector the rays of light from the lamp above are brought down and evenly diffused over the surfaces of the glasses comprising the safelight which are fitted to the lower portion of the lamp front.

The safelight glasses are eight by ten inches, affording ample illumination for the inspection of large plates.

The Wratten Safelight Lamp is constructed for use with electric light only, and includes electric lamp attachment with six feet of cord and plug and one safelight.

In ordering, specify which series of safelight is desired. If not specified, Series 2 will be furnished. Series 0 is best for wet-plate work.

THE PRICE

| | |
|---|---------|
| No. 1 Wratten Safelight Lamp (as above) - - | \$10.00 |
| No. 2 Wratten Safelight Lamp (without opening for white light) - - - - - | 8.00 |

Indirect Light Boxes

For general illumination of the dark-room, it is best to have a lamp box into which a Wratten Safelight is fitted, and to suspend it from the ceiling of the room, hanging down about 2 feet or 30 inches, with the Safelight towards the ceiling, which should be white, so that the room is illuminated by light reflected from the ceiling.

THE PRICE

| | |
|---|---------|
| Indirect light box for one 10 x 12 Safelight - - | \$ 9.00 |
| Indirect light box for two 10 x 12 Safelights - - | 18.00 |

Cord and plug are included but not safelights or electric bulbs.

Wratten & Wainwright Safelights

The safelight consists of one or two sheets of glass coated with a colored gelatin film, which transmits a perfectly safe light for handling the sensitive materials for which they are recommended.

SERIES 00. A clear yellow for use with lantern slide plates, gaslight papers, etc.

SERIES 0. A bright orange color suitable for Wet Collodion, bromide paper and lantern plates.

SERIES 1. An orange safelight for use with ordinary, medium, and rapid plates and films which are not color sensitive. Consists of yellow and orange coated glass with red paper between.

SERIES 2. A safelight for extra rapid and orthochromatic plates and films which are sensitive to green but not red.

COLLODION

This safelight consists of yellow and violet coated glass with deep red paper between.

SERIES 3. A green safelight for use with the red-sensitive panchromatic plates and film. Gives faint illumination, which however is quite strong as the eyes become accustomed to it. This safelight consists of yellow and green coated glass with green paper between.

SERIES 4. Bright green safelight for use with ordinary plates for those who are unable to use a red light. Not safe for orthochromatic plates.

These safelights can be used to special advantage in the Wratten Safelight Lamp described above.

| PRICE (any series) | |
|--------------------|----------------------|
| 5 x 7 - - - \$.75 | 10 x 12 - - - \$1.75 |
| 8 x 10 - - - 1.25 | |

Special sizes at an advance of 33 $\frac{1}{3}$ % above the price of next larger size from which they can be cut.

Eastman Mono-Lock Process Printing Frame

A convenient frame that opens or closes with one motion. Saves time, saves fatigue. Size to take 15" x 18" plate or smaller.

Complete, with 1 inch plate glass front - - - \$60.00

Transparent Kodaloid

Transparent film base in the (No. 1) Thinnest grade, may be used for protection of negatives that have to be frequently printed. The (No. 3) Heavy or (No. 6) Extra Heavy grade may be used as a support for stripped collodion negatives instead of glass, it is less expensive and occupies less space for storage and eliminates danger of breakage.

| THE PRICE | |
|-----------------------------|-----------------|
| No. 1 Thin - - - - - | 25c per sq. ft. |
| No. 2 Medium - - - - - | 25c per sq. ft. |
| No. 3 Heavy - - - - - | 30c per sq. ft. |
| No. 6 Extra Heavy - - - - - | 35c per sq. ft. |

Eastman Film

Eastman Film possesses the following advantages:

It affords negatives free from halation without the necessity of backing.

Perfect contact is assured, as there is no curve as with the glass plate.

The method of manufacture permits a more even coating than is possible on glass plates.

PRICE LIST

Many more films can be developed, fixed and washed at one time than can glass plates with similar equipment.

The films can be printed from either side, making reversal easy.

They are unbreakable and may be cut to any shape.

They require but little more room for storage than so many sheets of paper.

Eastman Film will be supplied in any width up to thirty-six inches, and in any length.

EASTMAN "PROCESS" Film for negatives or positives. Especially suitable for line negatives and all process subjects. Any desired degree of contrast either weak or strong may be secured with these films.

EASTMAN "COMMERCIAL" Film for negatives or positives. Less contrasty than "Process" Film and especially suitable for photogravure positives.

| PRICE PER DOZEN | | | | | | | |
|-----------------|---|---|--------|---------|---|---|---------|
| 5 x 7 | - | - | \$1.45 | 14 x 17 | - | - | \$13.70 |
| 8 x 10 | - | - | 3.20 | 16 x 20 | - | - | 18.40 |
| 10 x 12 | - | - | 5.60 | 18 x 22 | - | - | 22.80 |
| 11 x 14 | - | - | 8.05 | 20 x 24 | - | - | 27.60 |

EASTMAN "COMMERCIAL PANCHROMATIC" FILM, sensitive to all colors: PRICE PER DOZEN

| | | | | | | | |
|---------|---|---|--------|---------|---|---|---------|
| 5 x 7 | - | - | \$1.60 | 14 x 17 | - | - | \$15.10 |
| 8 x 10 | - | - | 3.55 | 16 x 20 | - | - | 20.25 |
| 10 x 12 | - | - | 6.20 | 18 x 22 | - | - | 25.10 |
| 11 x 14 | - | - | 8.90 | 20 x 24 | - | - | 30.40 |

Eastman Kodaline Paper. For making paper negatives. It will be found to give the greatest possible density, to be fast, and to be coated on an exceptionally fine-textured stock; in short, it has just the right qualities for lithographers and others wishing to use paper negatives.

In rolls—

| | | | | | | | |
|-----------------|---|---|--------|------------------|---|---|---------|
| 10 ft. x 20 in. | - | - | \$1.70 | 10 yds. x 20 in. | - | - | \$ 5.10 |
| 10 ft. x 40 in. | - | - | 3.40 | 10 yds. x 40 in. | - | - | 10.20 |

In sheets—

| Sizes | Dozen | Prices | Sizes | Dozen | Prices |
|---------|-------|--------|---------|-------|--------|
| 8 x 10 | - | \$.75 | 16 x 20 | - | \$2.80 |
| 10 x 12 | - | 1.15 | 17 x 20 | - | 3.00 |
| 11 x 14 | - | 1.40 | 18 x 22 | - | 3.50 |
| 14 x 17 | - | 2.10 | 20 x 24 | - | 4.20 |

Eastman Topping Powder

For Zinc Etching. In one pound packages \$1.00 each.

COLLODION

Eastman Engravers' Proofing Paper

A smooth, non-glaring, pure white proofing paper that takes ink readily. Weight 60 lbs. per ream, or over.

Size 20x24 inches. Per ream of 500 sheets - - \$24.00

Eastman Photogravure Tissue

Specially suitable for Rotary Photogravure.

In rolls 12 feet long by 36 inches wide, \$4.50 per roll.

Eastman Process Plates

Suitable for line and half-tone work, and all subjects in which great contrast is required in negative or positive.

| | | | |
|---------|-----------|--------|-----------|
| 5 x 7 | - - - - - | \$1.45 | per dozen |
| 8 x 10 | - - - - - | 3.20 | per dozen |
| 10 x 12 | - - - - - | 5.60 | per dozen |

Color-Sensitive Plates for Engravers

Wratten & Wainwright Process Panchromatic Plate for direct half-tone color work.

Wratten & Wainwright Panchromatic Plate for indirect color and object work.

These plates were the first plates highly sensitive to all colors, to be produced commercially. They are double coated to eliminate the halation which is so disturbing in color work.

PRICE PER DOZEN

| | | | | | |
|---------|-----|--------|---------|-----|---------|
| 5 x 7 | - - | \$1.80 | 14 x 17 | - - | \$17.25 |
| 8 x 10 | - - | 4.00 | 16 x 20 | - - | 30.75 |
| 10 x 12 | - - | 7.00 | 18 x 22 | - - | 42.75 |
| 11 x 14 | - - | 10.05 | 20 x 24 | - - | 53.25 |

Wratten & Wainwright Color Filters

For all purposes

These filters are in accordance with the very latest scientific developments and are universally recognized as the best to be obtained. Wratten & Wainwright three color filters are standard throughout the world.

Supplied in gelatin film, cemented in parallel plate glass or cemented in hand-worked optical plate of the very highest quality. Prices on Request.

Those interested in three color work are requested to ask for our Booklet "Reproduction Work with Dry Plates."

EASTMAN KODAK CO., Rochester, N. Y.



GETTY RESEARCH INSTITUTE



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